US010190454B2

(12) **United States Patent**
Naruoka et al.

(10) **Patent No.: US 10,190,454 B2**
(45) **Date of Patent: Jan. 29, 2019**

(54) **MOTORCYCLE SUPERCHARGER**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 634 days.

(21) Appl. No.: **14/591,803**

(22) Filed: **Jan. 7, 2015**

(65) **Prior Publication Data**

US 2015/0118025 A1 Apr. 30, 2015

Related U.S. Application Data

(63) Continuation of application No. PCT/JP2013/068900, filed on Jul. 10, 2013.

(30) **Foreign Application Priority Data**

Jul. 11, 2012 (JP) 2012-155463

(51) **Int. Cl.**
F01M 11/02 (2006.01)
F02B 33/40 (2006.01)
(Continued)

(52) **U.S. Cl.**
CPC ***F01M 11/02*** (2013.01); ***F01M 1/02*** (2013.01); ***F01M 5/002*** (2013.01); ***F01M 11/03*** (2013.01);
(Continued)

(58) **Field of Classification Search**
CPC F01M 11/02; F01M 11/03; F01M 1/02; F01M 2011/021; F01M 2011/022;
(Continued)

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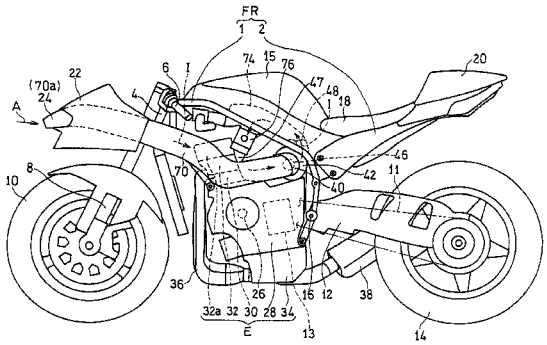
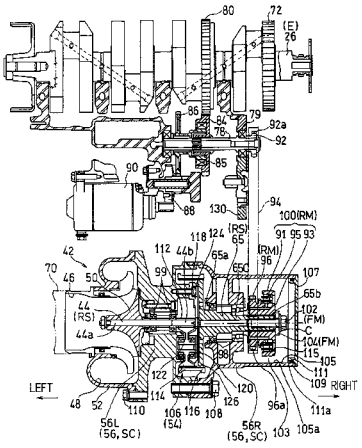
(57) **ABSTRACT**

An impeller for pressurizing an intake air of an engine is provided on a left side end portion in a supercharger rotary shaft of the supercharger. The power from the engine is transmitted to a second sprocket, which is provided on a right side end portion of an input shaft of a speed increaser, through a chain to thereby allow the supercharger to drive. The second sprocket is removably fitted to the input shaft by means of a bolt. The supercharger rotary shaft, the input shaft, the second sprocket and the bolt are all accommodated in a supercharger casing. The supercharger casing has a right side end face formed with an access opening through which access can be made to the second sprocket and the bolt from an axial direction.

7 Claims, 7 Drawing Sheets





(51) **Int. Cl.**

F02B 39/04	(2006.01)
F02B 61/02	(2006.01)
F02B 39/12	(2006.01)
F02B 67/10	(2006.01)
F04D 17/10	(2006.01)
F04D 29/62	(2006.01)
F02B 33/34	(2006.01)
F04D 29/054	(2006.01)
F01M 1/02	(2006.01)
F01M 5/00	(2006.01)
F01M 11/03	(2006.01)
F02B 33/00	(2006.01)
F04D 25/02	(2006.01)
F04D 29/60	(2006.01)

(52) **U.S. Cl.**

CPC ***F02B 33/00*** (2013.01); ***F02B 33/34*** (2013.01); ***F02B 33/40*** (2013.01); ***F02B 39/04*** (2013.01); ***F02B 39/12*** (2013.01); ***F02B 61/02*** (2013.01); ***F02B 67/10*** (2013.01); ***F04D 17/10*** (2013.01); ***F04D 25/02*** (2013.01); ***F04D 25/022*** (2013.01); ***F04D 25/028*** (2013.01); ***F04D 29/054*** (2013.01); ***F04D 29/601*** (2013.01); ***F04D 29/624*** (2013.01); *F01M 2011/021* (2013.01); *F01M 2011/022* (2013.01); *F01M 2011/026* (2013.01); *F05D 2220/40* (2013.01)

(58) **Field of Classification Search**

CPC ... F01M 2011/026; F01M 5/002; F02B 33/00; F02B 33/34; F02B 33/40; F02B 39/04; F02B 39/12; F02B 61/02; F02B 67/10; F04D 17/10

USPC 415/559.1, 122.1, 170.1, 206; 123/559.1

See application file for complete search history.

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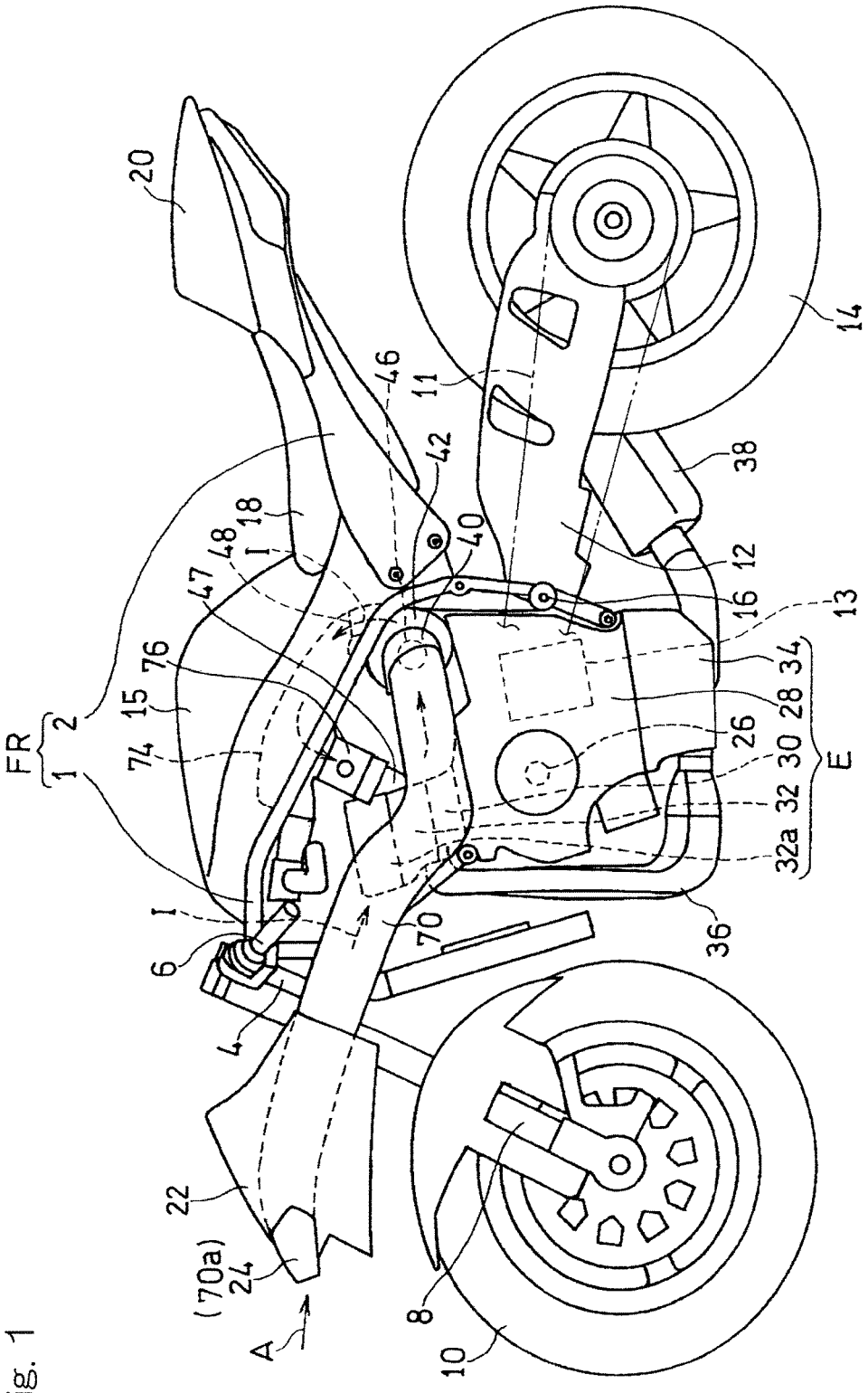
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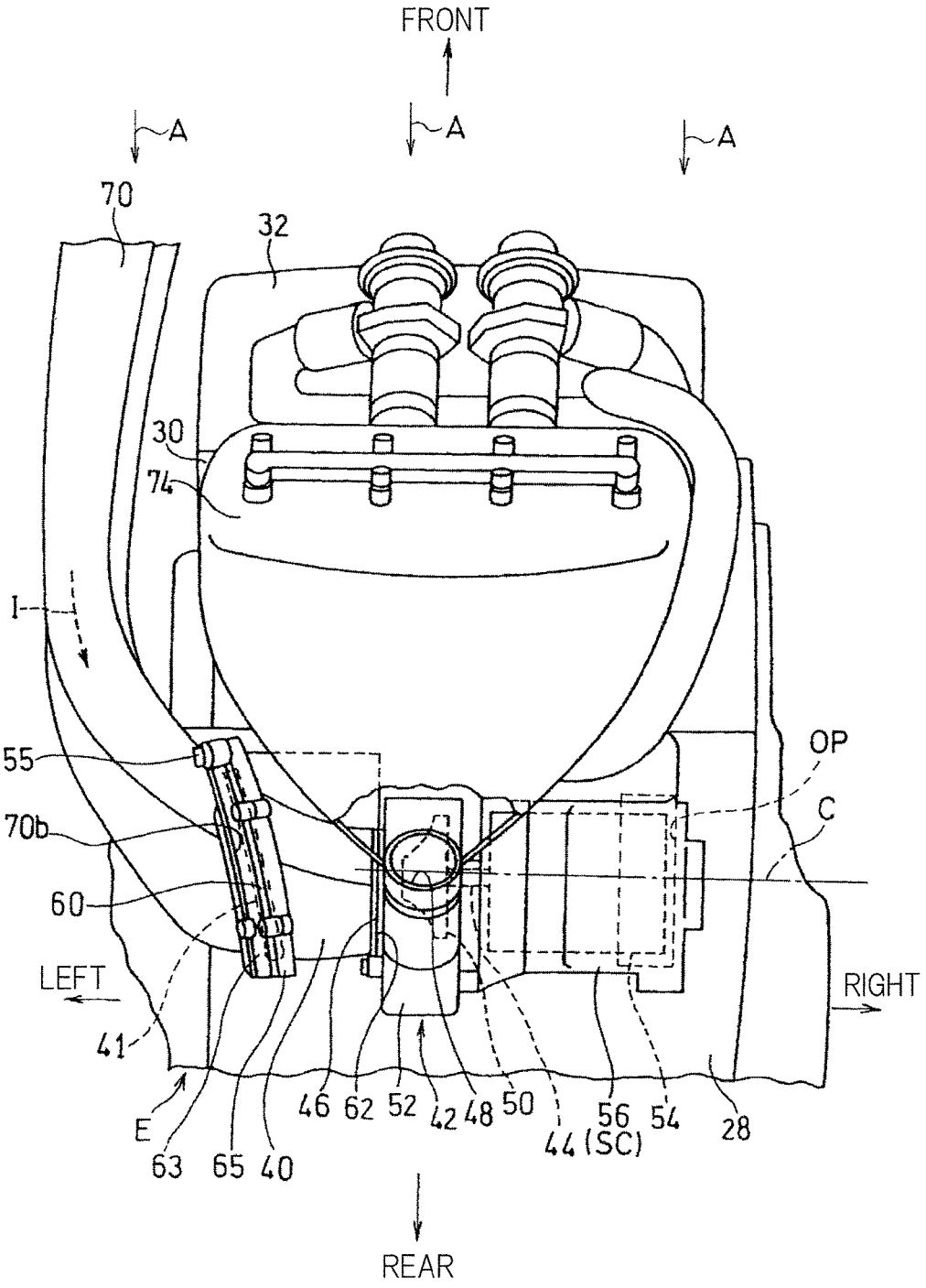
46
11
14
42
38
18
48
40
12
47
16
13
76
34
15
28
FR
2
74
26
30
E
1
32
32a
36
70
6
4
22
(70a)
24
A
8
10

Fig. 1

Fig. 2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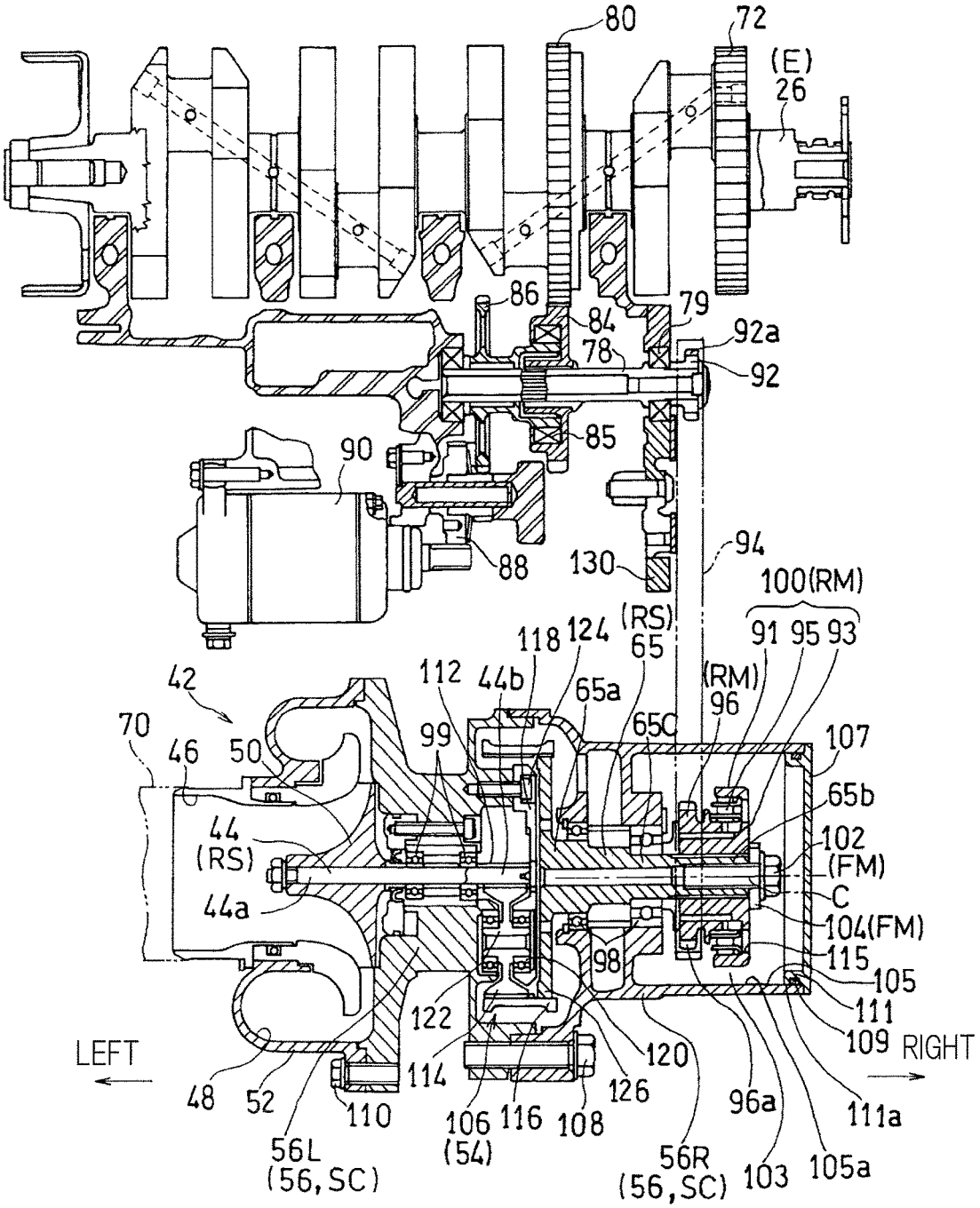
A
A
A
70
32
30
74
I
55
70b
60
OP
C
LEFT
RIGHT
41
E
63
65
40
46
62
52
42
48
50
44 (SC)
56
54
28
REAR

Fig. 3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72
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26
86
84
79
78
92a
92
85
90
88
130
94
100(RM)
91 95 93
118
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(RS)
65
112
44b
65a
(RM)
96
42
70
46
50
99
65C
107
65b
44
(RS)
102
(FM)
44a
C
104(FM)
98
115
105
111
109
RIGHT
LEFT
122
120
114
126
48
52
110
106
(54)
116
108
96a
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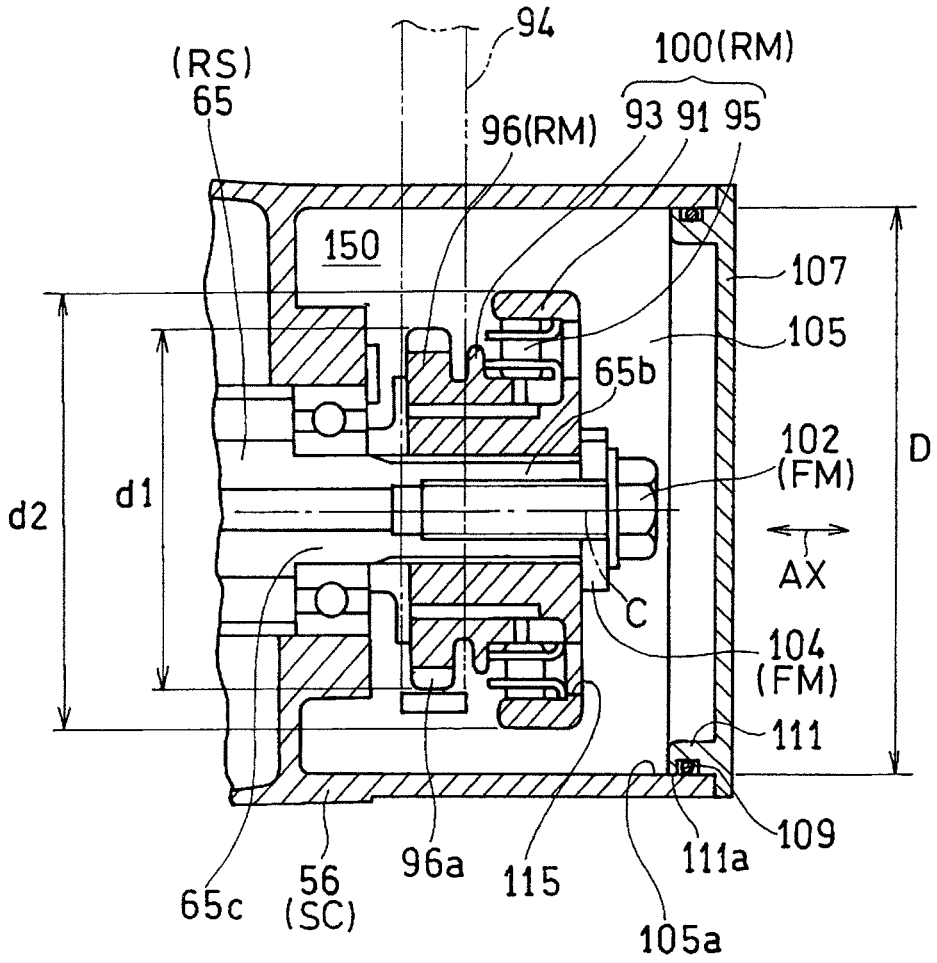
56L
(56, SC)
56R
(56, SC)
103
105a

Fig. 4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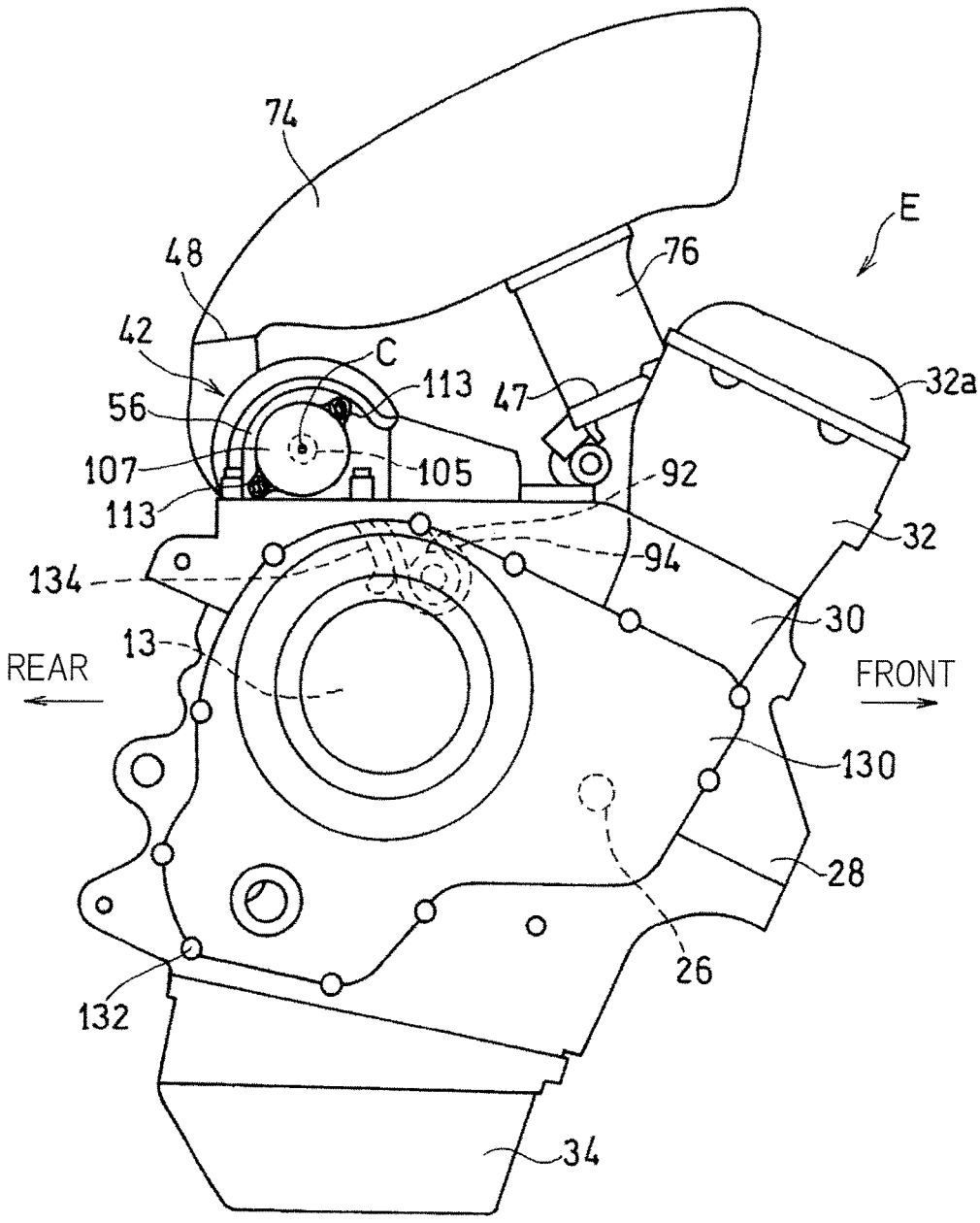
100(RM)
96(RM)
93 91 95
150
107
105
65b
102
(FM)
D
d2
d1
AX
C
104
(FM)
111
109
111a
65c
56
(SC)
96a
115
105a

Fig. 5


74
48
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56
107
113
C
113
47
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92
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76
E
32a
32
30
134
13
REAR
FRONT
130
28
26
132
34

Fig. 6

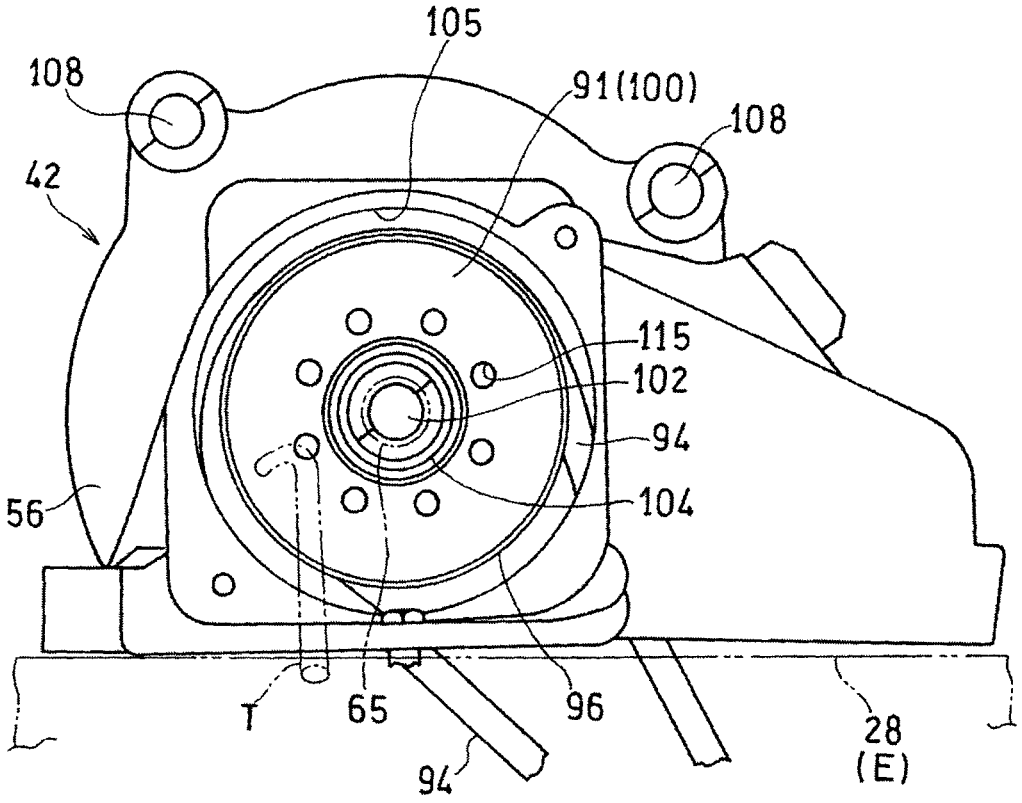
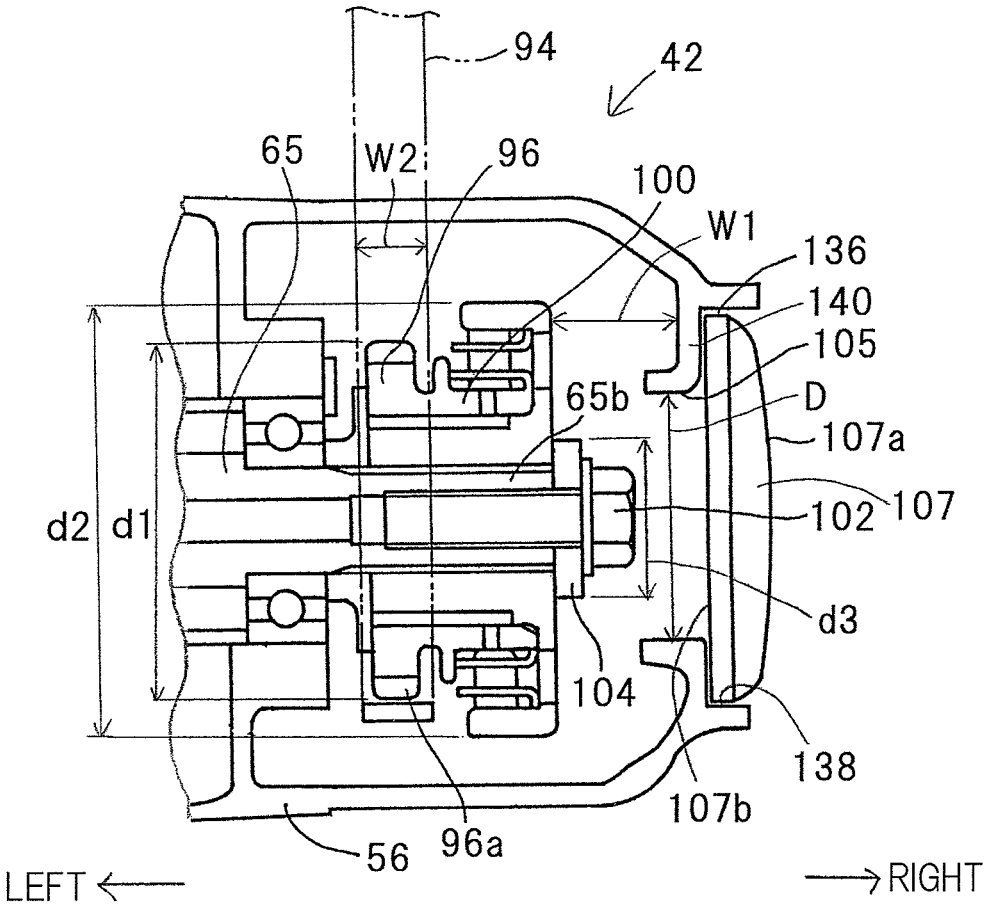


Fig. 7


94
42
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W2
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100
W1
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138
107b
56
96a
LEFT
RIGHT

MOTORCYCLE SUPERCHARGER

CROSS REFERENCE TO THE RELATED APPLICATION

This application is a continuation application, under 35 U.S.C. § 111(a) of international application No. PCT/JP2013/068900, filed Jul. 10, 2013, which claims priority to Japanese patent application No. 2012-155463, filed Jul. 11, 2012, the entire disclosure of which is herein incorporated by reference as a part of this application.

BACKGROUND OF THE INVENTION

Field of the Invention

The present invention relates to a supercharger that is fluid connected with an engine used on an automotive vehicle such as, for example, a motorcycle.

Description of Related Art

In a combustion engine mounted on the automotive vehicle such as, for example, a motorcycle, the use has been known of a supercharger for supplying an outside air after the latter has been pressurized. In this respect, see, for example, the Japanese patent document 1 listed below. This known supercharger is so configured as to be driven by the engine power in operative association with an endless chain mechanically coupled with an engine rotary shaft.

PRIOR ART LITERATURE

Patent Document 1: JP Laid-open Patent Publication No. 02-163539.

It has, however, been found that the supercharger of the type discussed above has a poor workability particularly when it requires repair and replacement of the chain.

SUMMARY OF THE INVENTION

In view of the foregoing, the present invention has been devised to substantially eliminate the problems and inconvenience and is intended to provide a supercharger capable of obtaining an increased workability.

In order to accomplish the foregoing object, the present invention herein disclosed provides a supercharged adapted to be driven by a power of an engine and to pressurize an intake air for the engine, which supercharger includes a rotary shaft body provided with a supercharge rotating body for pressurizing the intake air, a transmission rotating body which is provided in the rotary shaft body for transmitting the power to the rotary shaft body, and a supercharger casing to accommodate therein the rotary shaft body and the transmission rotating body. The supercharger casing is formed with an access opening that enables access from an axial direction of the rotary shaft body to the transmission rotating body.

It is to be noted that the transmission rotating body referred hereinabove and hereinafter is, for example, a sprocket, a pulley or a gear and may include one way clutch between the transmission rotating body and the rotary shaft body. The rotary shaft body includes, in addition to the supercharger rotary shaft provided with an impeller, a rotary shaft of a speed increaser if the latter is interposed between the supercharger rotary shaft and the transmission rotating body.

According to the present invention as described above, in a condition with the supercharger casing fitted, the transmission rotating body can be fitted to or removed from the rotary shaft body through the access opening, resulting in increase of the workability. Where the power is transmitted to the transmission rotating body through an endless stripe shaped transmitting member such as, for example, a chain or a belt, removal of the transmission rotating body from the rotary shaft body allows the endless stripe shaped transmitting member to be replaced in a condition in which the supercharger casing fitted.

Preferably, the supercharger casing may be fixed to a crankcase of the engine, and the rotary shaft body is rotatably supported by the supercharger casing. This structural feature allows the work of fitting or removal of the rotating body relative to the rotary shaft body to be accomplished in a condition in which the rotary shaft body is supported by the supercharger casing, and therefore, the workability increases further.

Preferably, the access opening may be closed by a cap which is removable relative to the supercharger casing. According to the structural feature, closure of the access opening with the cap is effective to avoid an undesirable ingress of foreign matter through the access opening.

In a preferred embodiment of the present invention, the use may be made of an annular sealing member interposed between an inner peripheral face of the access opening and an outer peripheral face of an engaging portion of the cap which portion is engaged with the access opening. In this case, the cap may be fastened to the supercharger casing by means of a fastening force acting in an axial direction of the rotary shaft body. According to this structural feature, no large fastening force necessary to held the sealing member under contact is needed and, therefore, the number of the fastening member can be reduced advantageously.

In the practice of the present invention, where a mounting member necessary to removably fit the transmission rotating body to the rotary shaft body is formed to a size large enough to pass through the access opening, the fitting member can be inserted or withdrawn through the access opening and, therefore, the workability increases further. Also, when the access opening is formed to a size enough to allow the transmission rotating body to pass therethrough, the transmission rotating body can be inserted or withdrawn through the access opening and, therefore, the workability increased further.

In another preferred embodiment, when the rotating body includes the one way clutch, such one way clutch may include a clutch outer ring rotatable together with the rotary shaft body, a clutch inner ring, and a clutch element disposed between the clutch outer ring and the clutch inner ring. In this case, a rotation transmitting unit is preferably formed in the clutch inner ring to transmit the power to the rotary shaft body. According to this structural feature, the need to use the rotation transmitting unit separately is dispensed with and the structure is accordingly simplified.

Any combination of at least two constructions, disclosed in the appended claims and/or the specification and/or the accompanying drawings should be construed as included within the scope of the present invention. In particular, any combination of two or more of the appended claims should be equally construed as included within the scope of the present invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In any event, the present invention will become more clearly understood from the following description of preferred embodiments thereof, when taken in conjunction with the accompanying drawings. However, the embodiments

and the drawings are given only for the purpose of illustration and explanation, and are not to be taken as limiting the scope of the present invention in any way whatsoever, which scope is to be determined by the appended claims. In the accompanying drawings, like reference numerals are used to denote like parts throughout the several views, and:

FIG. **1** is a side view of a motorcycle having mounted thereon a supercharger designed in accordance with a preferred embodiment of the present invention;

FIG. **2** is a perspective view, as viewed from diagonally upwardly, of an important portion of the motorcycle;

FIG. **3** is a diagram showing the arrangement of shaft of a drive system of the supercharger;

FIG. **4** is a fragmentary enlarged view of an important portion of FIG. **3**;

FIG. **5** is a side view of the combustion engine;

FIG. **6** is a side view showing the supercharger with a cap removed therefrom; and

FIG. **7** is an enlarged sectional view showing a different example of the supercharger.

DESCRIPTION OF PREFERRED EMBODIMENTS

Preferred embodiments of the present invention will be hereinafter described in detail. However, before the description of the embodiments of the present invention proceeds, it to be noted that the terms "left" and "right" used herein are to be understood as relative terms used to denote opposite directions or positions, respectively, as viewed from a vehicle driver then maneuvering the automotive vehicle.

FIG. **1** is a side view showing a motorcycle equipped with a supercharger designed in accordance with a preferred embodiment of the present invention. The illustrated motorcycle includes a motorcycle frame structure FR including a main frame **1**, which forms a front half section, and a seat rail **2** which is fitted to a rear portion of the main frame **1** and which forms a rear half section of the motorcycle frame structure FR. A front fork **8** is rotatably supported by a head pipe **4**, which is provided at a front end of the main frame **1**, through a steering shaft (not shown), and a front wheel **10** is fitted to this front fork **8**. The front fork **8** has an upper end portion to which a steering handlebar **6** is secured.

On the other hand, at the rear end portion of the main frame **1**, which is a lower intermediate portion of the motorcycle frame structure FR, a swingarm **12** is supported through a pivot pin **16** for pivotal movement up and down, and a rear wheel **14** is rotatably supported by a rear end portion of this swingarm **12**. A combustion engine is supported by a lower portion of the main frame **1**. Rotation of the combustion engine E is transmitted to a transmitting member **11** such as, for example, a chain disposed on a left side of the motorcycle body, through a transmission **13**, and the rear wheel **14** is driven through this transmitting member **11**.

A fuel tank **15** is disposed on an upper portion of the main frame **1**, and a driver's seat **18** and a fellow passenger's seat **20** are supported by the seat rail **2**. Also, a front fairing or cowl **22** made of a resinous material is mounted on a front portion of the motorcycle body so as to enclose an area forwardly of the head pipe **4**. The front cowl **22** is formed with an air intake opening **24** defined therein for drawing an intake air I to be supplied towards the combustion engine E from the outside.

The combustion engine E is in the form of a four cylinder, four cycle parallel multicylinder engine having a crankshaft **26** which is an engine rotary shaft and which extends in a motorcycle widthwise direction, that is, in a direction widthwise of the motorcycle body. It is however to be noted that the type of the combustion is not necessarily limited to that shown and described. The combustion engine E includes a crankcase **28** for supporting the crankshaft **26**, a cylinder block **30** connected with an upper portion of the crankcase **28**, a cylinder head **32** connected with an upper portion of the cylinder block **30**, a head covering **32***a* fitted to an upper portion of the cylinder head **32**, and an oil pan **34** fitted to a lower portion of the crankcase **28**. The crankcase **28** has a rear portion forming a transmission casing for accommodating therein a transmission **13**.

As shown in FIG. **5**, on a right side surface of the crankcase **28**, the transmission covering **130** is removably fitted by means of a plurality of bolts **132**, and removal of this transmission covering **130** allows the transmission **13** to be removed.

The cylinder block **30** and the cylinder head **32**, shown in FIG. **1**, are somewhat tilted forwards. Specifically the combustion engine E has a piston axis line which is tilted forwardly while extending upwardly. The cylinder head **32** has a rear portion provided with an air intake port **47**. Four exhaust pipes **36** fluid connected with exhaust ports at a front surface of the cylinder head **32** are merged together at a location below the combustion engine E and then fluid connected with an exhaust muffler **38** that is disposed on a right side of the rear wheel **14**. At a location rearwardly of the cylinder block **30** and upwardly of a rear portion of the crankcase **28**, a supercharger **42** for drawing an outside air and supplying it as the intake air I is disposed. In other words, the supercharger **42** is positioned upwardly of the transmission **13**.

The supercharger **42** compresses the outside air then sucked through a suction port **46**, and then, after the pressure of the air has been increased, discharges the air from a discharge port **48** to supply it to the combustion engine E. Accordingly, the amount of the intake air to be supplied to the combustion engine E can be increased. The suction port **46** of the supercharger **42** opens leftwards at a location upwardly of the rear portion of the crankcase **28** whereas the discharge port **48** opens upwardly in the vicinity of a motorcycle widthwise intermediate position.

As shown in FIG. **2**, the supercharger **42** includes a supercharger rotary shaft **44** extending in the motorcycle widthwise direction, an impeller **50** which is fixed to the supercharger rotary shaft **44** and forms a supercharger rotating body, an impeller housing **52** for enclosing the impeller **50**, a transmission mechanism **54** for transmitting the power of the combustion engine E to the impeller **50**, and a casing **56** for enclosing a large portion of the supercharger rotary shaft **44** and the transmission mechanism **54** from a radial direction. In the embodiment now under discussion, as the transmission mechanism **54**, a speed increaser **54** comprised of a planetary gear device as will be detailed later is employed. The casing **56** is fixed to an upper surface of the crankcase **28** of the combustion engine E by means of bolts (not shown).

More specifically, an opening OP is formed in the upper crankcase **28**, and the casing **56** is fixed so as to enclose the opening OP from above. A chain **94**, (shown in FIG. **3**) which is used to transmit the power to the supercharger rotary shaft **44**, passes through the opening OP. The detail of the chain **94** will be described later.

The speed increaser or set-up gear **54** and an air cleaner **40** are disposed on respective opposite sides of the impeller

housing **52** in the motorcycle widthwise direction. This impeller housing **52** is connected with the air cleaner **40** by means of bolts (not shown).

The suction port **46** of the supercharger **42** is fluid connected with an cleaner outlet **62** of the air cleaner **40**, and an air cleaner inlet **60** is fluid connected with an air intake duct **70** from the outside in the motorcycle widthwise direction. The air intake duct **70** introduces the incoming wind A, then flowing forwardly of the cylinder block **30**, into the supercharger **42**. The air cleaner inlet **60** and an discharge opening **70***b* of the air intake duct **70** are connected by connecting respective connection flanges **63** and **65**, which are provided in outer peripheries thereof, by means of a plurality of bolts **55**. A cleaner element **40** for purifying the intake air I is interposed between those connection flanges **63** and **65**.

An intake air chamber **74** is disposed between the discharge port **48** of the supercharger **42** and the air intake port **47** of the combustion engine E shown in FIG. **1**. This intake air chamber **74** is used to pool the intake air I that is supplied from the supercharger **42** to the air intake port **47**. The intake air chamber **74** is positioned above the supercharger **42**, and a large portion of the intake air chamber **74** is positioned rearwardly of the cylinder block **30**. As shown in FIG. **2**, the discharge port **48** of the supercharger **42** is fluid connected with a motorcycle widthwise intermediate portion of the intake air chamber **74**. Accordingly, the intake air I from the supercharger **42** is uniformly introduced into the plurality of air intake port **47** through the intake air chamber **74**.

As shown in FIG. **1**, between the intake air chamber **74** and the cylinder head **32**, a throttle body **76** is disposed. In this throttle body **76**, fuel is jetted into the intake air to form an air/fuel mixture, and this resultant air/fuel mixture is subsequently supplied into the cylinder. The fuel tank **15** referred to previously is disposed above the intake air chamber **74** and the throttle body **76**.

The air intake duct **70** is supported by the main frame **1** with a front end opening **70***a* facing the air intake opening **24** in the front cowl **22**, and serves to increase the pressure of the incoming air A, introduced from the opening **70***a* under the ram effect so as to introduce it into the supercharger **42** as the intake air I. The air intake duct **70** is disposed on the left side of the motorcycle body and, when viewed from side, extends rearwardly below a tip end portion of the handlebar **6** and then passes outside of the cylinder block **30** and the cylinder head **32** of the combustion engine E.

As shown in FIG. **3**, a clutch gear **72** is provided at a right side end portion of the crankshaft **26** of the combustion engine E, which is one side with respect to the motorcycle widthwise direction, and, on the left side of this clutch gear **72**, a supercharger gear **80** for driving the supercharger **42** is provided in the crankshaft **26**. A driven side supercharger gear **84**, which meshes with the supercharger gear **80** of the crankshaft **26**, is splined to a supercharger drive shaft **78** so that the driven side supercharger gear **84** can rotate together with the supercharger drive shaft **78**. A starter gear **86** is relatively rotatably supported by the supercharger drive shaft **78** and, between the driven side supercharger gear **84** and the starter gear **86**, a starter one way clutch **85** is interposed. The starter gear **86** is connected with a starter motor **90** through a torque limiter **88**.

Accordingly, when the starter motor **90** rotates while the combustion engine E is at stoppage, the starter one way clutch **85** is brought in a coupled position to allow a starting torque to be transmitted to the crankshaft **26**. Also, when the rotational speed of the crankshaft **26** attains at a speed higher than that of the starter motor **90** after the engine E has been started, the starter one way clutch **85** is brought to a decoupled position and the power transmission from the crankshaft **26** to the starter motor **90** is inhibited.

A right side end portion of the supercharger drive shaft **78** is provided with a first sprocket **92**. In other words, the first sprocket **92** is provided on the right side (shaft end side) of a bearing **79** that supports the supercharger drive shaft **78**. The supercharger drive shaft **78** is supported by the transmission covering **130** via the bearing **79**. The first sprocket **92** has a geared portion **92***a* around which the chain **94**, which is an endless power transmitting member for transmitting the power of the combustion engine E to the supercharger **42**, is entrained. This chain **94** is disposed on the right side which is the opposite side of the suction port **46** of the supercharger **42** and the transmission mechanism **11** for wheel drive. With the chain **94** being urged by a tensioner **134** (shown in FIG. **5**), a tension is applied to the chain **94**. Accordingly, no inter-shaft adjustment is needed.

A rotational force of the crankshaft **26** is transmitted to an input shaft **65**, which is drivingly connected with the supercharger rotary shaft **44**, from the supercharger drive shaft **78** and then through the chain **94**. Specifically, a second sprocket **96** is provided on a right side end portion of the input shaft **65**, and the chain **94** is entrained around a geared portion **96***a* of this second sprocket **96**. The input shaft **65** is a rotary shaft of the speed increaser **54**.

The supercharger rotary shaft **44** and the input shaft **65** cooperate with each other to form a rotary shaft body RS having one end provided with the impeller **50** and the opposite end provided with the second sprocket **96** which is a transmission rotating body for transmitting the power from the combustion engine E. The supercharger rotary shaft **44** and the input shaft **65** have a common axis C that aligns in the motorcycle widthwise direction, and where no speed increaser **65** is employed, the supercharger rotary shaft **44** and the input shaft **65** are formed by a single shaft body. Also, the second sprocket **96** forms the rotation transmitting unit which is a part of the transmission rotating body RM for transmitting the power from the combustion engine E to the rotary shaft body RS.

The input shaft **65** is in the form of a hollow shaft and is rotatably supported by the casing **56** through bearings **98**. Spline serrations are formed on an outer peripheral surface of a right side end portion **65***b* of the input shaft **65**, and the second sprocket **96** is connected with the input shaft **65** through a speed increaser one way clutch **100** splined with those spline serrations. In other words, the second sprocket **96** and the chain **94** are disposed on the right side, which is an outer side of the motorcycle body, of a to-be-supported portion **65***c* of the input shaft **65** that is supported by the bearings **98**. The speed increaser one way clutch **100** is disposed on an outer side of the chain **94**. In the embodiment now under discussion, the speed increaser one way clutch **100**, too, forms a part of the transmission rotating body RM.

The speed increaser one way clutch **100** is provided between the second sprocket **96** and the supercharger rotary shaft **44** so as to suppress a rotational variation of the power. This speed increaser one way clutch **100** has such a clutch structure that if the rotational speed on a downstream side exceeds the rotational speed on an upstream side, connection between the upstream side and the downstream side can be decoupled. Since this speed increaser one way clutch **100** is disposed on an outer side of the chain **94**, a design change can be easily accomplished, and also replacement thereof

can be accomplished. It is however to be noted that the speed increaser one way clutch **100** may be disposed on an inner side of the chain **94**.

As shown in FIG. **4**, the right side end portion **65***b* of the input shaft **65** has a female threaded portion defined on the inner peripheral surface thereof, and the speed increaser one way clutch **100** is mounted on the right side end portion **65***b* through a washer **104** by means of a head portion of a bolt **102** threadingly engaged with the female threaded portion referred above. The bolt **102** and the washer **104** cooperate with each other to form a mounting member FM for removably fitting the speed increaser one way clutch **100**, which is the transmission rotating body RM, to the input shaft **65** which is the rotary shaft body RS.

The speed increaser one way clutch **100** includes a clutch cup **91** forming a clutch outer ring **91** and rotatable together with the input shaft **65**, a clutch inner ring **93**, and a clutch element **95** disposed between the clutch outer ring **91** and the clutch inner ring **93**, and the clutch inner ring **93** is formed with the second sprocket **96**. Since as described above the clutch inner ring **93** and the second sprocket **96** are formed integrally, the number of component parts used can be reduced. The second sprocket **96** is disposed on an inner side (left side of the motorcycle widthwise direction) of the axial direction AX of the rotary shaft body RS in the speed increaser one way clutch **100**. The second sprocket **96** has an outer diameter d1 so chosen as to be smaller than the outer diameter d2 of the clutch cup **91** (that is, d1<d2).

The speed increaser one way clutch **100**, the second sprocket **96** and the bolt **102** are accommodated within a rotating body accommodating space **150** which is formed in a right side end portion of the casing **56**. In other words, the casing **56** forms a supercharger casing SC for accommodating therein the rotary shaft body RS, the transmission rotating body RM and the mounting member FM. On a right side end of the casing **56**, an access opening is formed so as to face the motorcycle outer side and this access opening **105** is closed by a cap **107**. The supercharger casing SC may however be comprised of a first section for accommodating the transmission rotating body RM and the mounting member FM and a second section for accommodating the rotary shaft body RS in a fashion separable from each other. Accordingly, the access opening **105** can be formed to have a large opening, and also the supercharger casing CS can be rendered to have a complicated casing shape.

Through the access opening **105**, access can be made from the axial direction AX of the rotary shaft body RS to the transmission rotating body RM and the mounting member FM, and the diameter D of the access opening **105** is so chosen as to be large enough to allow the second sprocket **96** and the speed increaser one way clutch **100**, both of which form respective parts of the transmission rotting body RM, and the bolt **102** and the washer **104**, both of which form the mounting member FM, to pass therethrough (that is, D>d2). As shown in FIG. **5** showing the combustion engine as viewed from right side, the cap **107** is fitted to the casing (supercharger casing) **56** by means of a fastening member **113**, such as, for example, bolts, from the motorcycle widthwise direction. In other words, the cap **107** is fastened to the casing **56** by the utilization of a fastening force acting along the axial direction AX of the rotary shaft body RS.

The cap **107** shown in FIG. **4** has an inner surface formed with a cylindrical mounting portion **111**, that protrudes inwardly thereof and engages with an inner peripheral surface of the access opening **105**. An annular sealing member **109** is interposed between the inner peripheral surface **105***a* of the access opening **105** and an outer peripheral surface **111***a* of the mounting portion **111**.

The clutch cup **91** has an end face formed with an engagement portion **115** in the form of a throughhole that is oriented towards the axial direction AX of the rotary shaft body RS. This engagement portion **115** is provided so as to be engageable with a removal tool, which can be inserted through the access opening **105**, to facilitate the removal of the clutch cup **91** towards an outer side of the axial direction AX.

The impeller **50** referred to previously is fixed to a left side end portion **44***a* of the supercharger rotary shaft **44** of the supercharger **42** shown in FIG. **3**, and a right side portion **44***b* of the supercharger rotary shaft **44** is connected with a left side end portion **65***a* of the input shaft **65** through a planetary gear device **106** which is the speed increaser **54**.

The supercharger rotary shaft **44** is rotatably supported by the casing **56** through bearings **99**. The casing **56** includes an input shaft casing portion **56**R for supporting the input shaft **65** and a rotary shaft casing portion **56**L for supporting the supercharger rotary shaft **44**, and the input shaft casing portion **56**R and the rotary shaft casing portion **56**L are connected with each other with the use of a casing fastening member **108** such as, for example, bolts. Also, the impeller housing **52** is connected with the casing **56** with the use of a housing fastening member **110** such as, for example, bolts. The impeller housing **52** is formed with the suction port **46**, open on the left side, and the discharge port **48** open upwardly.

As hereinabove described, the planetary gear device **106** is disposed between the input shaft **65** and the supercharger rotary shaft **44** and is supported by the casing **56**. The right side end portion **44***b* of the supercharger rotary shaft **44** is formed with an external gear **112** which is meshed with a plurality of planetary gears **114** arranged in a circumferential direction. In other words, the external gear **112** of the supercharger rotary shaft **44** functions as a sun gear of the planetary gear device **106**. Also, the planetary gears **114** are meshed with an internal gear (ring gear) **116** of a large diameter at allocation radially outwardly thereof. Each of the planetary gears **114** is rotatably supported by a carrier shaft **122** by means of bearings **120** mounted on the casing **56**.

The carrier shaft **122** has a fixture member **118** and this fixture member **118** is fixed to the casing **56** by means of a bolt **124**. In other words, the carrier shaft **122** is fixed. The internal gear **116** is meshed with an input gear **126** provided on the left side end portion of the input shaft **65**. As described above, the internal gear **116** is so meshed with the input gear **126** as to rotate in the same direction as that of the input shaft **65**, and with the carrier shaft **122** fixed, the planetary gears **114** rotate in the same direction as that of the internal gear **116**. The sun gear (external gear **112**) is formed in the supercharger rotary shaft **44** which will serve as the output shaft, and rotates in a direction counter to the direction of rotation of the planetary gears **114**. In other words, the planetary gear device **106** is operable to increase the speed of the rotation of the input shaft **65** and then to transmit it to the supercharger rotary shaft **44** in a rotational direction counter to that of the input shaft **65**.

When the crankshaft **26** shown in FIG. **3** rotates, the supercharger drive shaft **78** rotates in driving association with the crankshaft **26** because of the meshed relation between the supercharger gear **80** and the driven side supercharger gear **84**. When the supercharger drive shaft **78** rotates, the input shaft **65** is rotated through the chain **94** and

the supercharger rotary shaft **44** is also rotated through the planetary gear device **106**, resulting in the supercharger **42** being started up.

When the motorcycle runs, the incoming air A shown in FIG. **1** enters the intake air duct **70** through the air intake opening **24**, then is compressed by a dynamic pressure (ram pressure), and flows through the air intake duct **70** towards the air cleaner **40**. After the intake air I entering the air cleaner **40** has been purified in the air cleaner **40**, the intake air I is introduced into the supercharger **42**. The intake air I so introduced into the supercharger **42** is pressurized by the supercharger **42** and is then introduced into the combustion engine E through the intake air chamber **70** and then through the throttle body **76**. By the cumulative effect of the ram pressure and the pressurization in the supercharger **42**, the high pressure intake air can be supplied to the combustion engine E.

In the following, the manner of removing the second sprocket **96**, the speed increaser one way clutch **100**, the bolt **102** and the washer **104** will be discussed. At the outset, bolts **113** shown in FIG. **5** are loosened to allow the cap **107** to be removed. FIG. **6** illustrates a side view of the supercharger **42**, as viewed from right side, in a condition in which the cap **107** has been removed. Subsequently, the bolt **102** is loosened to allow the washer **104** to be removed from the input shaft **65** and then is pulled out from the access opening **105**. Finally, the removal tool T is engaged with the engagement portion (throughhole) **115** of the speed increaser one way clutch **100**, followed by removal of the transmission rotating body RM, including the second sprocket **96** and the speed increaser one way clutch **100**, from the input shaft **65** through the access opening **105**.

Where the chain **94** is to be replaced, release of the tension applied by the tensioner **134** (FIG. **5**) makes it possible to remove the chain **94** from the second sprocket **96**. Accordingly, the chain **94** tending to be loaded can be easily replaced. Also, since the second sprocket **96** can be mounted or removed, a sprocket having different diameter can be fitted. Also, removal of the transmission covering **130** by loosening the bolt **132** shown in FIG. **5** makes it possible to replace the first sprocket **92** easily. Accordingly, the speed increasing ratio can be changed.

In the construction hereinbefore described, in a condition with the casing **56** fitted, a work to fit or remove the second sprocket **96** and the speed increaser one way clutch **100** to or from the input shaft **65** can be accomplished by manipulating the bolt **102** with the tool T inserted from the access opening **105**. Accordingly, the workability increased. In addition, removal of the second sprocket **96** and the speed increaser one way clutch **100** from the input shaft **65** makes it possible to replace the chain **94** in a condition with the casing **56** having been fitted.

Also, in a condition in which the casing **56** is fixed to the crankcase **28** and the input shaft **65** is supported by the casing **56**, the work to fit or remove the second sprocket **96** and the speed increaser one way clutch **100** to or from the input shaft **65** can be accomplished and, therefore, the workability further increases.

Further, since the access opening **105** is closed by the cap **107** that is removable to the casing **56** shown in FIG. **4**, an undesirable ingress of foreign matter through the access opening **105** can be avoided.

In addition, the sealing member **109** is interposed between the inner peripheral surface **105***a* of the access opening **105** and the mounting portion **111** of the cap **107**, and the cap **107** is fastened to the casing **56** by the action of the fastening force acting along the axial direction AX. Therefore, no large fastening force for urging the sealing member **109** under pressure is necessary and the number of the fastening member can be reduced.

Yet, the access opening **105** is so sized as to allow the sprocket **96**, the speed increaser one way clutch **100**, the bolt **102** and the washer **104** to pass therethrough. Therefore, the second sprocket **96**, the speed increaser one way clutch **100**, the bolt **102** and the washer **104** can be inserted or removed through the access opening **105**, and accordingly, the workability increases yet further.

Moreover, since the second sprocket **96** is formed in the clutch inner ring **93** of the speed increaser one way clutch **100**, there is no need to use any extra sprocket wheel and, therefore, the structure is simplified.

FIG. **7** illustrates a different example of the supercharger **42** in accordance with the present invention. In the example shown in FIG. **7**, the access opening **105** have the inner diameter D that is chosen to be smaller than the outer diameter d1 of the second sprocket **96** and, also, smaller than the outer diameter d2 of the clutch cup **91** (that is, D<d1 and D<d2), but greater than the outer diameter d3 of the washer **104** (that is, D>d3). Also, the axial gap W1 between the input shaft **65** and the casing **56** is chosen to be greater than the width (dimension in the axial direction) W2 of the chain **94** (that is, W2<W1). Accordingly, even though the inner diameter D of the access opening **105** is smaller than the outer diameters d1 and d2, the chain **94** can be removed from the access opening **105**. More specifically, by loosening the bolt **102** to allow the second sprocket **96** to be displaced so that it can be removed from the second sprocket **96**, the tension of the chain **94** can be loosened and, thus, the maintenance of the chain **94** can be performed.

Also, in the example shown in FIG. **7**, a male threaded portion **136** is formed in an outer periphery of the cap **107**, a female threaded portion **138** is formed in an inner peripheral surface of the right side end of the casing **56**, and the cap **107** is threaded to the right side end of the casing **56**. In this case, it is preferred that a right side end face **107***a* of the cap **107** is formed with a groove or projection with which the cap **107** can be angularly displaced about the axis. In this example, the right side end face **107***a* of the cap **107** is formed with the groove (not shown). Accordingly, when the cap **107** is turned about the axis with a tool engaged in the groove (not shown), the cap **107** can be fitted to or removed from the casing **56**.

In addition, a right end portion of the casing **56** is formed with an abutment portion **140** with which a left side end face **107***b* of the cap **107** abuts. The abutment portion **140** is formed on the left side of the female threaded portion **138**, and the access opening **105** is formed in an inner peripheral surface of the abutment portion **140**.

Although the present invention has been fully described in connection with the preferred embodiments thereof with reference to the accompanying drawings which are used only for the purpose of illustration, those skilled in the art will readily conceive numerous changes and modifications within the framework of obviousness upon the reading of the specification herein presented of the present invention. By way of example, although in describing the preferred embodiment, the chain **94** has been shown and employed as the power transmitting member, either a belt or a gear train may be employed for the power transmitting member. Although in describing the preferred embodiment reference has been made to the use of the sprocket **96** and the speed increasing one way clutch **100** as a transmission rotating body, a pulley or a gear may be employed, and the one way clutch may not be necessary.

Also, besides the centrifugal type supercharger in which the impeller **50** is employed as the supercharge rotating body, the Root's type, the Lysholm type or the scroll type supercharger may be employed.

Accordingly, such changes and modifications are, unless they depart from the scope of the present invention as delivered from the claims annexed hereto, to be construed as included therein.

REFERENCE NUMERALS

28 . . . Crankcase
42 . . . Supercharger
44 . . . Supercharger rotary shaft (Rotary shaft body RS)
44*a* . . . One end portion of supercharger rotary shaft
50 . . . Impeller (Supercharge rotating body)
56 . . . Casing (Supercharger casing)
65 . . . Input shaft (Rotary shaft body RS)
65*b* . . . Other end portion of input shaft
91 . . . Clutch cup (Clutch outer ring)
93 . . . Clutch inner ring
94 . . . Chain
95 . . . Clutch element
96 . . . Second sprocket (Transmission rotating body RM, Rotation transmitting unit)
100 . . . Speed increaser one way clutch (Transmission rotating body)
102 . . . Bolt (Mounting member FM)
104 . . . Washer (Mounting member FM)
105 . . . Access opening
107 . . . Cap
109 . . . Sealing member
E . . . Combustion engine
I . . . Intake air

What is claimed is:

1. A motorcycle supercharger adapted to be driven by a power of an engine and to pressurize intake aft for the engine, the motorcycle supercharger comprising:

a rotary shaft body provided with a supercharger rotating body for pressurizing the intake aft, adjacent an air intake duct at one end of the rotary shaft body;

a transmission rotating body which is provided on the rotary shaft body for transmitting the power to the rotary shaft body, adjacent the other end of the rotary shaft body;

a supercharger casing to accommodate therein a second sprocket, the rotary shaft body, and the transmission rotating body;

a housing to enclose the supercharger rotating body;

a suction port formed in the housing adjacent the air intake duct in an axial direction of the rotary shaft body, and

a mounting member by which the transmission rotating body is removably fitted to the rotary shaft body, wherein

the supercharger casing is formed with an access opening that enables access from the axial direction of the rotary shaft body to the transmission rotating body, the access opening being formed in the supercharger casing on an opposite side of the supercharger rotating body relative to the transmission rotating body with respect to the axial direction of the rotary shaft body,

the access opening has an outside diameter larger than that of the mounting member so as to enable the mounting member to pass therethrough,

the power of the engine being transmitted to the transmission rotating body through an endless stripe-shaped transmitting member,

the endless stripe-shaped transmitting member is entrained around a first sprocket of the engine and the second sprocket, and

a supercharger drive shaft which is connected to the first sprocket and is supported by a transmission covering.

2. The motorcycle supercharger as claimed in claim **1**, wherein the access opening is closed by a cap removable relative to the supercharger casing.

3. The motorcycle supercharger as claimed in claim **2**, wherein when the closed cap covers the access opening, the motorcycle supercharger further comprises an annular sealing member interposed between an inner peripheral surface of the supercharger casing and an outer peripheral surface of a mounting portion of the cap, wherein the cap is fastened to the supercharger casing by means of a fastening member acting in the axial direction of the rotary shaft body.

4. The motorcycle supercharger as claimed in claim **1**, wherein:

the transmission rotating body is disposed in the access opening relative to a bearing for supporting the rotary shaft body in the axial direction of the rotary shaft body; and

the outside diameter of the access opening is larger than that of the transmission rotating body so as to enable the transmission rotating body to pass therethrough.

5. The motorcycle supercharger as claimed in claim **1**, wherein the supercharger rotating body is an impeller.

6. The motorcycle supercharger as claimed in claim **1**, wherein the access opening is formed at an opposite side of the suction port of the supercharger relative to the transmission rotating body.

7. The motorcycle supercharger as claimed in claim **1**, wherein a planetary gear device includes a sun gear mounted on the rotary shaft body to transfer the power from the transmission rotating body to the rotary shaft body.

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